

A Streetcar named “Utility”: Useful and Reliable Knowledge in China in the Second Millennium

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This essay explores the term “useful knowledge” as it was discussed and defined by the Peking “Society for the Diffusion of Useful Knowledge in China”, established in 1872 by a group of colonial officials, merchants, and missionaries. Setting out from the scope of “Useful and Reliable Knowledge” as defined by the URKEW (Useful and Reliable Knowledge in Global Histories of Material Progress in the East and the West) group for imperial China, it presents the case of architectural handbooks between the twelfth and the eighteenth centuries. This includes both those published by state authorities and those in circulation among artisans, focusing on their different contents and implicit understandings of “usefulness”.

The term “useful and reliable knowledge” has intrigued and still puzzles many scholars, especially those who work on world regions where the common language of codification of technical knowledge is not English. Recently, Karel Davids has shown that the term “useful knowledge” was not applied in the same sense in Central and Western Europe, nor in America, and its semantic range has been narrowed down in the course of the sixteenth century to the present.¹

The Peking “Society for the Diffusion of Useful Knowledge in China”

Before looking at the Chinese record for examples of endogenous technographical writings and their application in the field of architecture, we may reflect on the transfer of the English term “useful knowledge” to China. This transfer took place in the nineteenth century in the form of an enlightenment campaign that set out to bring Western science and technology to China. One exemplary institution, a “Society for the Diffusion of Useful Knowledge in China” (hereafter: Society) was founded in Peking in the year 1872. This was not the first time that such an initiative took place. An earlier society with the same name had been set up in Canton in 1834.

¹ Karel Davids, “Gatekeeping. Who Defined ‘Useful Knowledge’ in Early Modern Times?”, *History of Technology*, 31 (2012), 69-88. I thank the author for making the prepublished version of his article available to me.

Recently, its objectives have been discussed both by Michael Lazich, who referred to the information on the United States that was offered to Chinese readers in its journal and book publications², and by Songchuan Chen, who highlighted the conjunction of Western missionary and commercial interests within this association.³ He challenges the view that the Sino-Western exchange of information and the spreading of knowledge on Western science and technology were intended as an alternative to military warfare with China.⁴ Merchant concerns prompted the British government to engage in warfare over the immediate issue of opium destroyed by Chinese government representatives in the harbour of Canton in 1839. Likewise, the larger objectives of liberalization of trade and foreign policies with China led to friction. In the course of the first Opium War (1839-1842), the Canton diffusionist society suspended its work. After a lapse of about thirty years, as a consequence of the Opium Wars, treaty ports were opened in China, trade and the possibility of missionary activity were conceded to Western powers, and diplomatic relations were officially established. The policy of the Chinese government towards modernization had changed, foreigners were no longer officially forbidden to learn and communicate in Chinese, and some of them were employed by Chinese government institutions as teachers and advisors in several large modernization projects.

In this situation, the inauguration of the Peking Society was reported in the English language biweekly journal *North China Herald* of February 22, 1872. Its founders referred back to the original Society for the Diffusion of Useful Knowledge that had been established in England forty years earlier, but not to its Canton predecessor.⁵ This may be due to the fact that the persons involved in the Peking Society were completely different. Yet it is unlikely that the Chinese language publications and the journal of the Canton Society, which had a certain impact upon the

² Michael C. Lazich, "Placing China in Its 'Proper Rank among the Nations': The Society for the Diffusion of Useful Knowledge in China and the First Systematic Account of the United States in Chinese", *Journal of World History*, 22/3 (2011), 527-551.

³ Songchuan Chen, "An Information War Waged by Merchants and Missionaries at Canton: The Society for the Diffusion of Useful Knowledge in China, 1834-1839", *Modern Asian Studies*, 46/06 (Nov. 2012), 1705-1735. My thanks to Kuo Ya-pei for information on the latter article, and for discussion of the merchant-missionary nexus in her presentation "Who needed it and why? Boundary setting and transgressing in Nineteenth-Century Protestant Missionaries' Chinese writings on history" at the workshop "Religion in motion: boundary work in the global religious field", Käthe Hamburger Kolleg, Ruhr Universität Bochum, 22 March 2013.

⁴ Songchuan Chen (n. 3 above), 1708.

⁵ The actual date would be 1826. See Janet Percival, *The Society for the Diffusion of Useful Knowledge, 1826-1848* (London 1978).

Chinese intellectuals of their time, were unknown to the representatives of the Peking Society.⁶

Like the London Society, the Peking Society planned to set up a magazine comparable to the *Penny Magazine*, “The most useful attempt ever made, to impart sound knowledge to the lower and middle classes by means of cheap but well-written papers”, stating that the “advanced culture of the English people” was largely to be attributed to magazines and popular journals. The founders of the Chinese society, which included certain “prominent sinologues”, as well as missionaries, presumed that there was “a growing desire on the part of the natives to ‘better their estate’ by the adoption of certain obvious Western appliances”, and sought for subscriptions, especially among the treaty port residents, for this project of “secular mission”.⁷ Its objective, formulated in its first annual report, was “by the introduction of modern science and liberal thought, to endeavour to overthrow those ancient superstitions which constitute the most formidable barriers in the way of material and social improvement” and “to prepare the way for inevitable innovations by rendering the idea of such changes familiar to the public mind, and leading the Chinese to regard them with desire instead of aversion”.⁸ In this sense, it aspired to further the interests of the “civil and mercantile classes of the Foreign community” by “diffusing juster views of the position and power of Western countries” and “lifting a voice that is heard in high places in favour of systematic efforts towards developing the internal resources of the Empire”.⁹ Yet the Peking Society was short-lived. It was first complemented by a reading room for the Chinese in Shanghai but was suspended after three years, since Peking, which was not yet connected by telegraph to the outside world and somewhat isolated from the South during the winter months due to infrastructure problems,¹⁰ seemed an inconvenient

⁶ Songchuan Chen (n. 3 above), 1719-1721, has a list of the published books. The title of the journal, which was published between 1834 and 1838 by the general editor Karl Gützlaff was *Dong Xi yang kao meiyue tongjizhuan* (East-West monthly magazine). Relating to the esteem held by the Chinese for the journal and the other publications of the Canton Society, see Chen, note 3, 1722-24.

⁷ *North China Herald*, 22 February 1872, issue 0251, 138. Ralph R. Covell, *W.A.P. Martin: Pioneer of Progress in China* (Washington, 1978), 200, refers to W.A.P. Martin as one of the founders of the Society. Unlike in the case of the Canton Society, the names of the founders were not published. Cf. “Proceedings relative to the Formation of a Society for the Formation of Useful Knowledge in China”, *Chinese Repository* (Dec. 1834), 390-391.

⁸ *North China Herald*, 29 January 1874, issue 0352, 89.

⁹ *ibid.*

¹⁰ *North China Herald*, 23 December 1875, issue 0450, p. 633.

place for a periodical publication. Thus, in 1876 it transmitted its activities and journal to the Shanghai Polytechnic School and the *Chinese Scientific Magazine*.¹¹

The issue of usefulness was a subject of debate in the British community in China. One particularly concerned commentator, who published under the pseudonym “Philo-Chinese”, pointed out in a letter to the editor of the *North China Herald*, that what was useful for the British was not (yet) useful for the Chinese. The British, he reasoned, were prepared to receive knowledge in modern science and technology, such as astronomy, engineering, electricity, chemistry, botany, engineering, mineralogy, and mechanics, because they had first been “schooled thoroughly in the political truths that permitted the sciences to find a natural home in the nation; and there was an established acknowledged immunity from oppressive taxation, pre-existing as conditions *sine qua non* for the introduction of these scientific utilities.” On the contrary, electricity (for instance) would be practically useless for the Chinese “so long as they cannot employ this grand element of civilisation”. In this observer’s opinion, information on socio-political issues for the entire population was more useful than “to feed the Chinese with scientific twaddle that will tickle the mandarin by a further exhibition of European cleverness”.¹²

The record of this treaty port journal shows that in contemporary understanding, not everybody considered the usefulness of knowledge of modern science and technology to be universal. Furthermore, the issue as to whether Western religious writings, especially the Bible, should be included in the Shanghai Reading Room for Chinese works, captured the attention of the committee members. These missionaries, traders, and diplomatic representatives are relevant in the sense of the URKEW research project. Prominent primary sources of information are John Fryer (1839-1928), a sinologist, mathematician and historian of Chinese science who for a period worked in the service of the Chinese government as an educator and director of translation projects in the Shanghai Arsenal; Alexander Wylie (1815-1887), who had been active in the Chinese and Foreign Bible Society; and Sir Walter Henry Medhurst (1822-1885), the son of the renowned missionary and Bible translator Walter Henry Medhurst, who was also a representative of British imperialist interests in various functions, such as Consul

¹¹ *North China Herald*, 24 February 1876, issue 0459, 165.

¹² *North China Herald*, 4 April 1872, issue 0257, 268-9.

at Hankow and Shanghai. After the initiative of the Peking Society, and the subsequent reading room project, a further Society for the Diffusion of Useful Knowledge, established in Shanghai in 1877, concentrated on producing school and textbooks.¹³ A more expressly Christian initiative, the “Society for the Diffusion for Christian and General Knowledge”, active in translating and distributing religious, historical, and scientific foreign literature in China, was founded in 1888.¹⁴

Many late nineteenth-century Chinese and Britons conceived of knowledge both in modern natural sciences and Western technology as well as in philosophy and ethics as an indivisible combination. This can be visually imagined in the proposed design of a reading room for the Chinese public that was planned in 1872. It was to be provided with the Chinese Confucian Classics and

“such practical works on scientific subjects as have been well translated into the native language. The walls should be hung with good pictures of machinery and modern inventions, and everything should be done to enlist the interest, and attract the curiosity of the visitors. We have no doubt some little prejudice might exist against the institution for a while, as it would probably be regarded as a new and subtle form of propagandism, but in time we believe the really useful objects of the Reading Room would be recognized, and the natives would frequent and appreciate it.”¹⁵

Based upon a closer look at the *Peking Magazine*, or, as the Chinese title reads, “Things heard and seen in China and the West” (*Zhong Xi wenjian lu*), and considering the question of how to conceptualize the “usefulness” of the knowledge presented in this publication, one finds that the Society for the Diffusion of Useful Knowledge in China among the Chinese, which raised the funds for the monthly journal, is not mentioned as an institution in the preface. “Usefulness” as such is not conceptualized in a formal sense. Instead, the preface utilizes a long phrase to express that “the advantages of the various methods of the West with respect to China are not small” (*Xiguo zhufa*

¹³ *North China Herald*, November 21, 1878, issue 0600, 502. The Chinese name was Yizhi shuhui 益智書會 (Book Society for Augmenting Wisdom), see Zhang Jian, “Jindai kexue mingci shuyu shending tongyi zhong de hezuo, chongtu yu kexue fazhan” (Cooperation, conflict, and scientific advances in the process of determining and standardizing modern scientific terminology), *Shilin* (Historical Review) 2/2007, 24-35, p. 26.

¹⁴ “Society for the Diffusion of Christian and General Knowledge among the Chinese: First Annual Report”, *North China Herald*, December 14, 1888, issue 1115, p. 659; January 25, 1888, issue 1069, 86. The Chinese name was Guangxue Hui 廣學會 (Society for Broadening Knowledge).

¹⁵ “Secular Missionaries”, *North China Herald*, 26 December, 1872, issue 0295, 548.

youyi yu Zhongguo fei xiao 西國諸法有益於中國非小)¹⁶. A decade later, Chinese intellectuals who advocated technological reform in the so-called self-strengthening movement juxtaposed “Western utility and Chinese essence” in the phrase *Zhongxue wei ti, Xixue wei yong* (Chinese learning is the body/core/essence, Western learning is the use/utility/application)¹⁷, which implied that the Chinese cultural and spiritual core was to be maintained while Western use or utility, in the sense of technological knowledge and appliances, should be adopted. One might speculate whether the activities of the Western diffusionist societies and their stress on “usefulness” may have had an indirect impact in expanding the conceptual breadth of *ti* and *yong*, which originates from the classical philosopher Xunzi in the third century BC and was expounded upon in the Neo-Confucian thought of the eleventh and twelfth century.¹⁸

In articles written in Chinese by Western and Chinese contributors, the 36 issues of the journal *Zhong Xi wenjian lu* included information on the three fields: applied technology, sciences, and contemporary Western political systems and events, as well as entertainment in the form of travelogues and anecdotes from various countries.

The very first article was by the author W.A.P. Martin (1827-1916), an American Presbyterian missionary, translator and provost of the first school for interpreters and Western learning, the Tongwen Guan, in Peking. This essay is dedicated to the road steamer, a kind of steam locomotive (steam tram or steam tractor) running on rubber tyres, which is not dependent on rails.¹⁹ Such machines, invented in Scotland and adapted to conditions in the United States, were applied mainly to agriculture and transport. The article explains the basic capabilities and specifications of the machine and mentions its possible advantages for China: speed, power (15 HP for the big and 6 HP for the small vehicle), adaptability to the terrain and most of all its

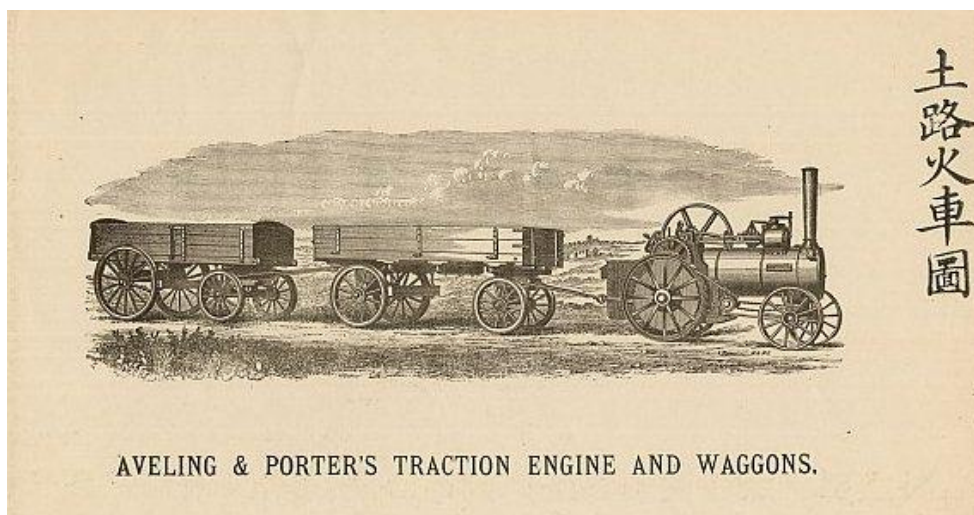
¹⁶ “Xu” (Preface), *Zhong Xi Wenjian Lu / The Peking Magazine*, 1 (August 1872), 3-5, 4, installed on website of the Australian National Library, <http://nla.gov.au/nla.gen-vn514067> (last accessed Aug 22, 2013), 1-4.

¹⁷ The extension of the *ti-yong* dualism with its implications of complementary Western and Chinese learning was attributed to Zhang Zhidong and his circle. See Hao Yen-p’ing and Wang Erh-min, “Changing Chinese views of Western relations, 1840-95”, *The Cambridge History of China*, vol. 11, *Late Ch’ing, 1800-1911*, Part 2, 142-201 (Cambridge etc., 1980), p. 201.

¹⁸ *Zhongguo ruxue cidian* (The Dictionary of Chinese Confucianism), (Shenyang, 1988), 700.

¹⁹ Ding Weiliang [W.A.P. Martin], “Lun tulu huoche” (The Road Steamer, illustrated), *Zhong Xi wenjian lu / The Peking Magazine*, 1 (August 1872), 9-13. Illustration retrieved from National Library of Australia Digital Collections. Books and Serials, <http://nla.gov.au/nla.gen-vn514067>, 10 (last accessed Aug 17, 2013).

labour-saving qualities. It was available at 5,000 taels for the large and 2,000 for the small vehicle. An illustration of the road steamer of one particular firm, Aveling and Porter, the largest producer, was appended. Its use for military logistics was also vaunted.



Whether this item, given its high price and the fact that human labour was hardly scarce in China, was really a “useful” device seems doubtful. One demonstration of its capabilities was performed in Tianjin by the English consulate at just about the time when W.A.P. Martin’s article appeared. This was reported in the Chinese language newspaper *Shenbao*. The local authorities, who were quite impressed, gave this device the fitting name of “utility” (*liyong*). No further information about this – or any other – road steamers is available, as China ventured, with halts and hesitation, into the era of railroads. The tram lines of Beijing were electrified (1899 - c. 1900, then again from 1924 on), Tianjin (since 1906), and Shanghai (since 1908). Thus, “utility” was well-intentioned but not particularly useful or affordable in this period.²⁰

This is only one example in a host of efficient new appliances which were introduced, together with fundamental knowledge in sciences, mathematics, and medicine taught in modern institutions such as the Arsenals and correlated schools in China.²¹ The usefulness or impact of Western knowledge, natural science and applications in general cannot be disputed. Yet the Western missionary and merchant

²⁰ “Tianjin shixing tulu huoche” (Experimental Run of a Road Steamer in Tianjin), *Shenbao* (Shanghai Daily), 30 September 1872, 3.

²¹ On the range and the impact of missionary educational initiatives concerning the introduction of Western science and technology in China, see Benjamin Elman, *On their own Terms: Science in China, 1550-1900* (Cambridge, MA, 2005), chapter 4, “Modern Science and the Protestants”, 281-319.

discourse which often described Chinese traditional technology in disparaging terms, was not always to the point. If “usefulness” implies, as Ting Xu explains, “economic [...] or potential commercial utility”²², not all of the promoted Western technology, even though functional, was advantageous, considering the costs of acquisition, maintenance, and the sources of energy.

As late as the end of the nineteenth century, the religious embedment of useful and reliable knowledge was a matter of great hope to part of the proponents, while others argued against it. This should be seen against the backdrop of the conjuncture of the “demotion of religion” and the Scientific Revolution²³. Yet for some Western promoters of science and technology in China, it was obvious that religious and missionary messages were linked up inseparably with useful and reliable knowledge.

Chinese technological writings: The case of architectural handbooks

Useful knowledge – and here we apply ex post definitions in Karel Davids’ sense,²⁴ refers broadly to knowledge with a technological impact. The question arises here as to in which respect traditional Chinese technological writings were considered as “useful” in the endogenous understanding, and whether this comprehension has changed according to present-day conceptions of the history of science and technology. After all, the missionaries and merchants of the mid- and late nineteenth century thought it necessary or profitable to convey Western types of mechanical and electromechanical (as well as medical and pharmaceutical) technology to a region where it was as yet unknown, with the intention of complementation and replacement of the techniques hitherto applied. As Ting Xu has shown, late imperial Chinese elites considered useful knowledge to be “self-cultivation, family management, national

²² Xu Ting, “A Cultural and Institutional Study of Useful and Reliable Knowledge: the Case of Traditional China [Discussion paper]”, URKEW Discussion Paper Series, 4, <http://www2.lse.ac.uk/economicHistory/Research/URKEW/papers/Xu.pdf>, 2, fn 3. Cited with the author’s permission.

²³ Patrick O’Brien, “Stages in the Evolution of a Western European Regime for the Discovery, Development and Diffusion of Useful and Reliable Knowledge”, URKEW Discussion Paper Series, 7, 35-6. <http://www2.lse.ac.uk/economicHistory/Research/URKEW/Discussionpapers.aspx> (last accessed September 6, 2013).

²⁴ Davids (n. 1 above), 69.

administration and the maintenance of the whole social order”.²⁵ The achievement of an administration, according to these values, lies in the increasing sophistication and accountability of administrative practice from the side of the central government. Merely maintaining a stable livelihood for a largely increasing population (and not increasing living standards) may seem to be a “failure” in the advancement of knowledge and its practical and commercial application. Yet value systems as to what is useful and reliable knowledge are different between different civilizations. Even in Great Britain, as Ian Inkster points out, the government did not always foster new insights into nature and the application of its potential.²⁶

The types of technical compendia available in late Imperial China have been comprehensively described in *Science and Civilisation in China*, the multi-volume series initiated by Joseph Needham. In many instances, they show the relationship of knowledge conserved and diffused by the central government, and in works by literati connoisseurs and by experts.

Even in pre-imperial China, architecture and civil engineering rank prominently within the administrative tasks of polities. The extreme importance of organization and account-keeping for relevant projects can be seen in the first century BC arithmetical handbook “Nine chapters on the art of calculation” (*Jiu zhang suanshu*). This text uses the amounts of earth to be moved for the construction of walls, city walls, ditches, and dykes as examples for the calculation of volume and mass, and gives instructions on how to reckon the necessary man-days of forced or conscripted labourers on such building sites.²⁷ Yet actual handbooks for building techniques are extant only from the second millennium onwards. The various types of relevant writings can be grouped as representing technological knowledge for and by representatives of the state, or for *literati* and other elites not in official service for the government, or for artisans. These compilations differ largely in scope and content. The works commissioned by the state are mainly concerned with state architecture, such as palace and ceremonial buildings.

²⁵ Xu Ting (n. 33 above), 7.

²⁶ Ian Inkster, “Potentially Global: ‘Useful and Reliable Knowledge’ and Material Progress in Europe, 1474-1914”, *The International History Review*, Vol. 28, No. 2 (June 2006), 237-286, esp. pp. 244-246, p. 264.

²⁷ *Jiuzhang suanshu*, transl. and ed. by Karine Chemla and Guo Shuchun, *Les neuf chapitres: Le Classique mathématique de la Chine ancienne et ses commentaires* (Paris, 2004), Chapter 5, “shang gong/Discuter des travaux”, 410-457.

The most famous example of the early twelfth century is the *Yingzao fashi* (Building Methods), published by the Office of Building under the Ministry of Public Works of the Song Dynasty. It was compiled by an official in the Ministry of Public Works, the Superintendent of State Buildings Li Jie (d. 1110). Based on consultations with master artisans and filed material in the Ministry²⁸, it was completed in 1100, and printed in 1103. It contains 34 chapters with rules, norms, and methods of building; rules on labour, and on use of material. The work was provided with drawings, which were lost and redone in later editions. The original is no longer extant, but fragments of copies relatively close in time (from the 1230s) exist. Many manuscript and printed copies were transmitted; at least one has been traced in each subsequent century. They were copied for the use of private book collectors. While it expressly deals with public architecture, the elements of the book, such as the basic principles of modular calculation, introducing relative units of material and of working time, or the qualities and processing of specific building materials, especially timber and clay, could be applied in private buildings as well.²⁹ Researchers of the *Yingzao fashi* assume that the order to compile this work most likely stands in conjunction with a change in the corvée organisation, which provided that rather than summoning building workers to unpaid work in the public service, they were paid according to the rules fixed here.³⁰ The building standards, as far as prices and wages for materials were concerned, were again listed in a compilation by a Minister of Public Works, He Shijin (d. 1625) in his work “What should be known about the Workshops of the Ministry of Public Works” *Gongbu changku xuzhi* (in 1615). However, it was six centuries after the *Yingzao fashi* that a compendium of a similar type was edited between 1734 and 1736. These are the so-called “Technical instructions for the [building] crafts” *Gongcheng zuofa*. They were compiled by a large board headed by an imperial prince, Yunli (1697-1738). The eighteenth and nineteenth centuries were the age of the compilation of so-called “handicraft regulations” (*jiangzuo zeli*). Many of them were commissioned and

²⁸ Li Jie, *Yingzao fashi*, ed. *Siku quanshu*, “chazi” 劄子, fol. 1a.

²⁹ Joseph Needham, *Science and Civilisation in China*, Volume 4: *Physics and Physical Technology*. Part III: *Civil Engineering and Nautics* (Cambridge, 1971), 66-68; Guo Daiheng, “The Liao, Song, Xi Xia, and Jin Dynasties”, in Fu Xinian et al., *Chinese Architecture* (Yale etc., 2001), 135-197, pp. 187-189.

³⁰ Else Glahn, “On the Transmission of the *Ying-tsaο fa-shih*”, *T’oung Pao* 61 (1975), 232-265, p. 236, and by the same author, “Bauvorschriften im Alten China”, in Wilfried Nerdinger (ed.), *Die Kunst der Holzkonstruktion: Chinesische Architekturmodelle* (Munich etc., 2009), 12-17, pp. 13, 17.

compiled by departments within the Ministry of Public Works or other Ministries; they also dealt with shipbuilding, weaponry, imperial vehicles, coin casting, river conservancy and more specific areas of engagement.³¹ The *Gongcheng zuofa* came as a set together with the *Gongbu zeli*, that is, more general administrative rules about the administration and maintenance of buildings and other tasks of the Ministry, including the supervision of labour and the maintenance of stocks; and the later *Wuliao jiazhi zeli*, the regulations on prices and wages to be paid for public work projects. In comparison to the *Yingzao fashi*, the *Gongcheng zuofa* is generally regarded with certain reservations by architectural historians who point out that it is not as original as the previous book, and only codifies existing regulations.³² Since numerous abridged versions existed, it is evident that the *Gongcheng zuofa* was widely circulated.³³ One important piece of evidence on how official rules may have spread to the private sector and influenced the experts in the provinces has been found by the architectural historian Caroline Bodolec. This concerns the vault construction of the cave dwellings in hNorthwest China. Naturally, the 1734 regulations did not discuss this type of dwellings, which belonged to the private rather than the public sector, but they include general principles of calculation of arch constructions for city gates. This was adapted for cave dwellings in the eighteenth century. The official terminology, which uses terms not common in the vernacular, was well-known to the builders whom Bodolec interviewed in the 1990s. A transmission of knowledge certainly had taken place, but the constructors were not aware of this.³⁴

Manuscripts and writings of more confined, local impact that discussed and gave instructions for local buildings and labour arrangements have come to surface, such as

³¹ For a list of extant handicraft regulations see Christine Moll-Murata, Song Jianze, Liu Qiang, “Union List of Handicraft Regulations of the Qing Dynasty in Chinese and International Collections”, in Moll-Murata, Song and Hans Ulrich Vogel (eds.), *Chinese Handicraft Regulations of the Qing Dynasty: Theory and Application* (Munich, 2005), 521-559.

³² Klaas Ruitenbeek, *Carpentry and Building in Late Imperial China: A Study of the Fifteenth-Century Carpenter's Manual Lu Ban Jing* (Leiden etc., 1993), 4; Else Glahn, “Unfolding the Chinese Building Standards: Research on the *Yingzao fashi*”, in Nancy Shatzman Steinhard (ed.), *Chinese Traditional Architecture* (New York, 1984), 47-57, p. 48.

³³ See Moll-Murata, Song, Liu (n. 31 above), 542-544.

³⁴ Caroline Bodolec, “The Technology of the Vault Structure in Chinese Architecture: Links between the *Gongcheng zuofa* and the Contemporary Building Methods of *yaodong* Houses in Shaanxi and Shanxi Provinces”, in Moll-Murata, Song, Vogel (n. 31 above), 213-232, p. 217, where Bodolec discusses the architectural calculation procedures to find the necessary measurements and sizes for the construction of stone or brick vaults which were used both in court and vernacular architecture.

“Requirements and organization of work on city walls” *Chenggong shiyi*, a manuscript in the holdings of the library of the Chinese Academy of Sciences. It certainly had a much lower circulation than the 1734 regulations - if it was circulated at all. It was written later than 1744, and gives advice from officials to their colleagues. Such types of sources may exist for further individual building projects as well.

There are other texts that can be attributed to experts who recorded measurements and calculations of particular buildings, mostly those constructed for the state. They sometimes read like abridgements of the 1734 official building regulations.

It is quite possible that the provincial administrations, which were obliged to provide data on materials and wages of their respective jurisdictions for the information of the central government, also had copies of the building guide *Gongcheng zuofa* in their offices. From there, the terminology and the know-how may have spread to the local construction sites.

Besides those works that were compiled by the imperial authorities or that were related to dynastic building projects, certain works written by individual house or garden owners are also extant. This can be characterized as connoisseur literature by and for those who wished to demonstrate their understanding of an elegant lifestyle. For example, Ji Cheng’s *Yuanye* (The Garden Smith, 1635), which was meant for people who wanted to supervise the design of the architectural parts of their gardens, or Li Dou’s *Yangzhou huafang lu* (The Pleasure Boats of Yangzhou, 1797), which treats the subject of architecture among other topics, and lists terminology rather than technical procedures. Klaas Ruitenbeek in his classification of works relating to building in pre-modern China also mentions household encyclopedias, geomantic works and almanacs.³⁵ The latter clearly show that people believed in, or respected the beliefs that there were propitious days for almost all human activities, prominently including the construction of houses, doors, furniture, stoves and wells, additional buildings, such as lavatories and stables for cattle, digging wells and ponds, buildings, dams and roads. These were published in popular almanacs.

The “Classic of the [Carpenters’ Saint] Lu Ban” *Lu Ban jing*, compiled around 1400, is one of the very few handbooks from that time relating to private construction. It

³⁵ Ruitenbeek (n. 32 above), 34-44.

was analyzed by Klaas Ruitenbeek in his respective monograph. The editors (and probably authors) of this book were three officials of the Ming dynasty Building Department, but the content is presented as the teachings of the patron saint of the trades of construction and interior decoration. It describes measurements, proportions and particular work procedures for buildings and furniture. Furthermore, the book pays attention to propitious days for construction and auspicious positions for buildings and parts of buildings. After the late Ming, a further section related to construction charms and magic was probably appended.³⁶ The charms shown in the book were thought to be able to influence the lives of all humans and animals dwelling in the respective houses or stables. A protective charm could be, for instance: “If two coins are put on the ridge-pole, one left and one right, long life, wealth and happiness will prevail. The husband will win fame, the son will obtain a noble rank, and titles of honour will be bestowed on the wife. Sons and grandsons will wear robes of office for generations to come.”³⁷ A negative charm would be: “A broken rice bowl and a single chopstick cause sons and grandsons to end up as beggars. Lacking food and clothing, they will be always cold and hungry, after having sold their house, they will live under bridges or in temples.”³⁸ Both objects were meant to be hidden in the door frame.

Contemporary observers warned one should beware of the anger of the carpenters. Some of them were convinced that the concomitant sorcery was morally justified by the stinginess and maltreatment of the carpenters by employers.³⁹ However, keeping the carpenters contented was not only a matter of fair wages or prices for the labour they performed. As Ruitenbeek explains, the social position of carpenters was far below the importance of their technical skills for everyday life.⁴⁰ Acknowledgement of their skills and fair treatment, according to an author of an eighteenth century household encyclopaedia, was the best way to prevent harmful building magic.⁴¹

One part of the *Classic of Lu Ban* contains illustrations and sayings about entirely and partially defective buildings and their influence on the lives of their inhabitants. It advises, for instance, that door gates should not be higher than the main

³⁶ Ruitenbeek, loc. cit.

³⁷ Ruitenbeek, 303.

³⁸ Ibid.

³⁹ Ruitenbeek, 89.

⁴⁰ Ruitenbeek, 83.

⁴¹ Ruitenbeek, 89.

hall, because otherwise boys would not be born, or that if doors are askew, husbands and wives would not get along; if door stiles are mended, this would bring about sore eyes, stomach pains, and aching feet; and if the walls at both sides of the door are not equally sized, wives would be changed and children would be orphaned.⁴² Unlike the first parts of the book, these poems and illustrations address the house owners rather than the building artisans. They more or less directly call for good workmanship and good (and higher-priced) materials. For instance, broken door boards seem to incite ghosts to haunt and cause family wealth to wane, “but by mending the door, poverty may be avoided”⁴³, or holes in walls near the gate and defective street pavement will cause misfortune in the proprietor’s family, wherefore “repairs should be made quickly without delay.”⁴⁴ As for material used (see illustration below): “The boards of a door may not have many knots, / for then one will grow boils and ulcers continuously. / If they are in rows of three or two, / It only causes your sons to leave as soldiers in the army.”⁴⁵



門板莫令多柄節
 生瘡疔不歇三三
 兩兩或成行徒配
 出軍郎

⁴² Ruitenbeek, 278.

⁴³ Ruitenbeek, 279, no. 11, Illustration *Huitu Lu Ban Jing* (Illustrated Classic of [the Patron Saint] Lu Ban), ed. by Pu Shizhao ([Shanghai] 1938), 30. For an analysis of the transmission of various editions of the work, see Ruitenbeek, 117-147.

⁴⁴ Ruitenbeek, 279, Nr. 7.

⁴⁵ Ruitenbeek, 279, no. 9.

Is such knowledge useful, and most of all, is it reliable? This is not expressly claimed anywhere in the text. However, it is clear by implication from the statement in the preface, the “Biography of the Immortal Master Lu”, that the information given in this book was to be preserved for all generations thereafter. Here it is pointed out that

“[...] even if my understanding is sufficient to grasp fully the spirit of construction, how would it be possible that ten thousand generations all over the world would by their own efforts have an understanding like mine? If their understanding is not like mine, then my own understanding will die with me, and my skill as well. So having strained the power of my eye to the utmost, I extend it by means of compasses and square, level and ink line so that when I want to build palaces and houses publicly and privately, to construct ships or carriages, to assemble implements and pottery, the methods that were used by people in the past should not surpass my own perfect method and self-tested way.”⁴⁶

The underlying cosmographical and geomantic assumptions can be outlined in the following manner. One of the most important forms of divination, the so-called “art of scheduling and positioning”⁴⁷, was not deemed to be superstitious in China. It was believed to originate from the natural universe itself, not from a transcendent power.⁴⁸ Specific days, for instance, were singled out to be propitious or inauspicious according to calendrical calculations in the hexagenary cycle.

In contrast, Patrick O’Brien describes many contemporaneous European natural philosophers as “true believers”, who accepted “the primacy of revelation and the subordination of their discipline as a handmaiden to theology”, although a minority supported the separation of metaphysical and physical knowledge.⁴⁹

Geomantics and chronomantics have had a long and venerated tradition since early imperial China. The popular almanacs became more elaborate from the Song onward,⁵⁰ so that these widely circulated compilations tended to include ever more detailed prognostications as to which activities needed to take into account the ascribed

⁴⁶ Ruitenbeek, 153.

⁴⁷ Thomas F. Aylward, *The Imperial Guide to Feng-Shui and Chinese Astrology: The Only Authentic Translation from the Original Chinese* (London, 2007), chapter 1.

⁴⁸ Aylward, chapter 1.

⁴⁹ Patrick O’Brien, “Stages” 12, 14.

⁵⁰ Endymion Wilkinson, *Chinese History. A Manual* (Cambridge, MA, 2000), 173.

noxious or auspicious influences of the cosmos.⁵¹ Interestingly, Ruitenbeek assumes that the *Lu Ban Jing* may not even have been used as a reference book by practitioners of carpentry. The actual work procedures were learned and executed by the artisans and their apprentices in practice rather than by referring to written treatises.⁵² According to Ruitenbeek, the geomantic and chronomantic content made this book important to house owners, geomancers, and artisans, but it had no absolutely determining influence over the actual position of the edifice.⁵³ This was due to the fact that the chronomantic system had the flexibility to offer alternative solutions for problems of supposedly inauspicious position and timing. Contemporary skeptics questioned both the effect of observing auspicious and inauspicious days and on the ability of carpenters to work negative magic upon those living in their constructions, but such voices were much rarer than the overwhelming belief by most people in geomantics and chronomantics.

On the other hand, the regulations of the various echelons in the administration of building projects usually do not contain prognostic contents. Why? One plausible explanation is that more specialized handbooks for the imperial administration existed, such as the 1740 “Treatise on Harmonizing the Times and Distinguishing Directions” (*Xieji bianfang shu*).⁵⁴ The concern of the imperial regulations and precedents of the Ministry of Public Work was product quality, accountability and cost control. Thus, we have here an example where the two fields of the actual building and the cultural embedment were separated in the highly complex division of labour that applied during the Qing administration.

Conclusion

Reflecting on the various possibilities as how to define useful and reliable knowledge, we have looked at the period in the mid- and late nineteenth century when the Anglo-American concept of “useful knowledge” was transposed to China. Colonial officials, missionaries and merchants thought that scientific knowledge and technical equipment (together with Christianity) should be spread to the Chinese, and that this

⁵¹ Ruitenbeek, 106.

⁵² Ruitenbeek, 145-6.

⁵³ Ruitenbeek, 145.

⁵⁴ Translated by Aylward (n. 47 above), n. 38.

should be provided either for free or on a commercial basis. These colonialist groups had the impression that China was technologically backward, hampered by superstitious beliefs and possessing an obsolete and dysfunctional political system.

On the other hand, we have seen that the Chinese state established important norms for technical procedures in the field of architecture. The most influential writings on constructions were created by government officials, and this corresponds to a particular understanding of usefulness: maintaining order and giving norms for society. Scholarly knowledge about the number of technical writings commissioned by the state, especially at the lower administrative levels of prefectures and districts may increase over time, and possibly more handbooks on popular technical knowledge may resurface. Yet it is unlikely that the craftspeople who actually did the hands-on work during Ming and Qing China frequently referred to such written handbooks. Mantic knowledge and beliefs permeated popular construction, so that it seemed hardly possible to build without considering propitious and inauspicious positions and days. Divinatory beliefs and ceremonial usages still abound in building worldwide; more so in East Asia than in Europe. However, even in Germany, traditionally minded families still make sure that carpenters perform some rites before a house is finished. This can be considered as folklore, and can hardly be taken into account as “useful” factual and physical knowledge in the sense of the URKEW project. Nevertheless, it shows that certain techniques are culturally embedded in many, if not all, regions worldwide.

It is unlikely that sensational findings will bring to light the existence of a hitherto unknown Chinese Copernicus or Newton of the sixteenth to eighteenth century. Nevertheless, in our days Chinese researchers and laboratories are catching up and competing in the race for Nobel and other prizes and awards for achievements in the natural sciences and medicine. In the field of building, high-rise architectural constructions are quite common in all Chinese cities. The process of globalization has thus brought together aspects of different cultures which previously have seemed to be irreconcilable to each other. While the West has been in the vanguard of technological advance for the last few centuries, one may feel that even historians, who professionally focus on the past, should reflect upon as to where the rapid blending of world cultures will carry humanity from here on.